

[54] **HUMIDITY REGULATING SYSTEM
FOR PRINTING MACHINES**

[72] Inventors: **Helmut Schone**, Radebeul; **Horst Henkenhae**, Dresden; **Lothar Vetter**; **Horst Krause**, both of Radebeul, all of Germany

[73] Assignee: **Veb Polygraph Leipzig, Kombinat fur polygraphische Maschinen und Ausriestungen**, Radebeul, Germany

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[51] Int. Cl.**F26b 13/10**

[58] Field of Search**34/44, 46, 50; 165/20, 21; 236/44 C; 101/147, 148**

[56] **References Cited**

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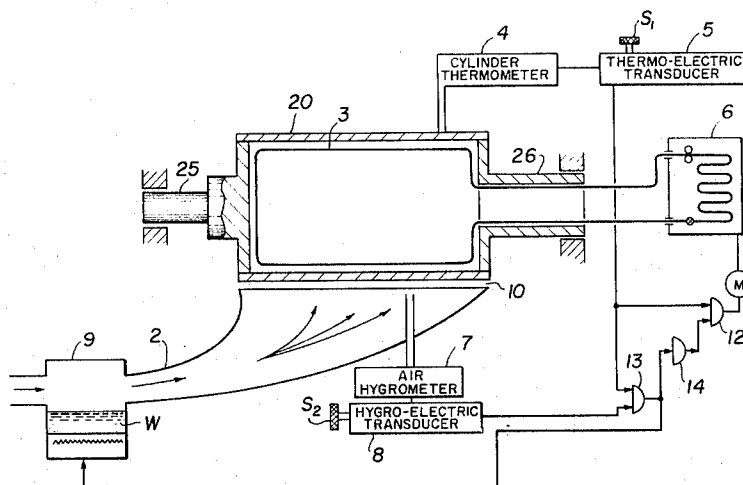
Primary Examiner—Carroll B. Dority, Jr.

Attorney—Nolte and Nolte

[57] **ABSTRACT**

A system for regulating the amount of humidity, and mainly the thickness of a humidity film, present on printing cylinders, and for thereby influencing acceptance or rejection of printing media. A first subsystem measures and regulates a first characteristic and particularly the temperature that prevails on the cylinder surface or in the layer of air, directly at this surface. A second subsystem measures and regulates a second characteristic and particularly the humidity of a stream of air, supplied to said surface, or the flow rate of this stream, or both. The two sub systems are pneumatically interconnected or electromechanically linked.

6 Claims, 7 Drawing Figures



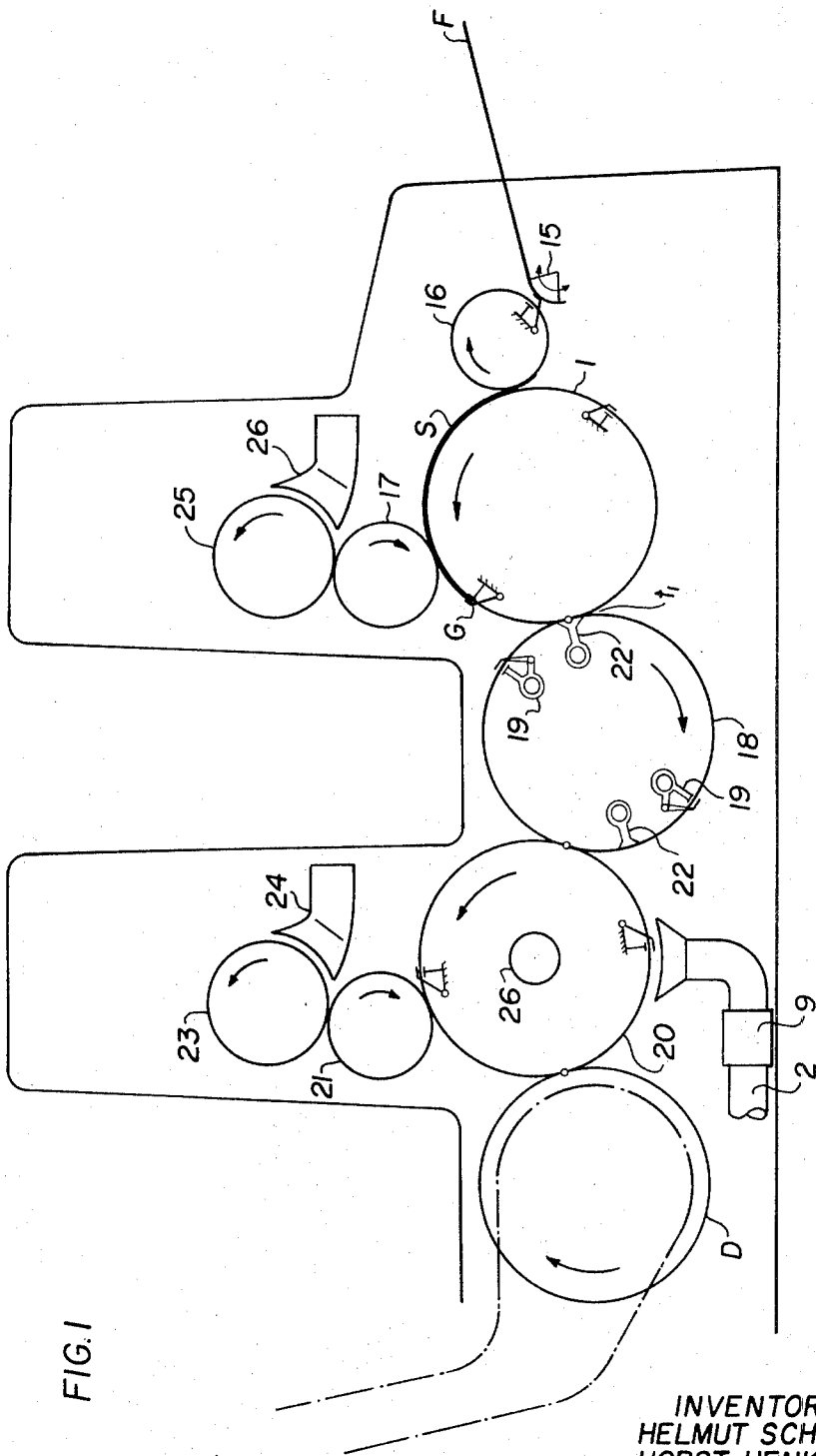


FIG. 1

INVENTORS
HELMUT SCHÖNE
HORST HENKENHAF
LOTHAR VETTER
HORST KRAUSE

BY *Nolte & Nolte*
ATTORNEYS

FIG. 2

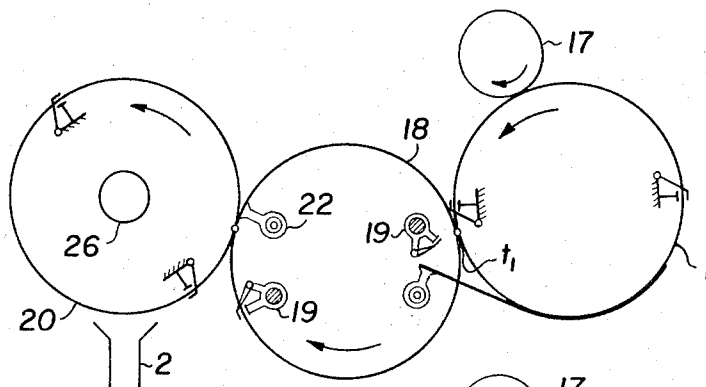


FIG. 3

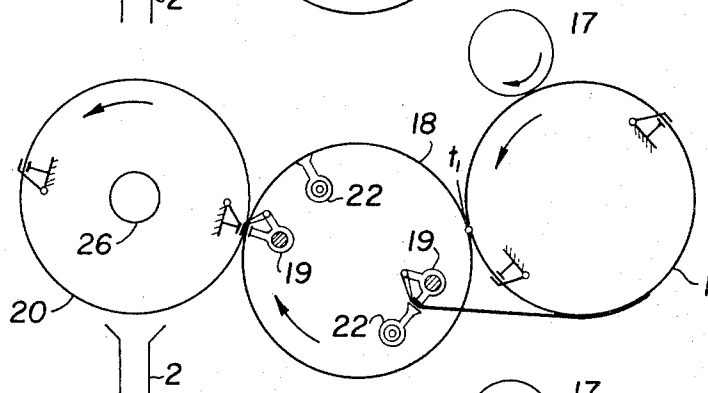


FIG. 4

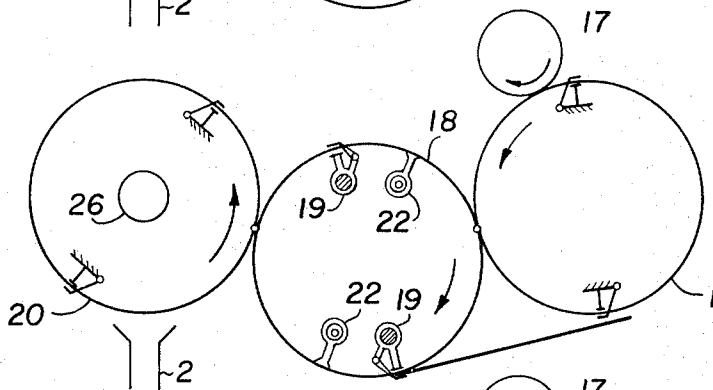
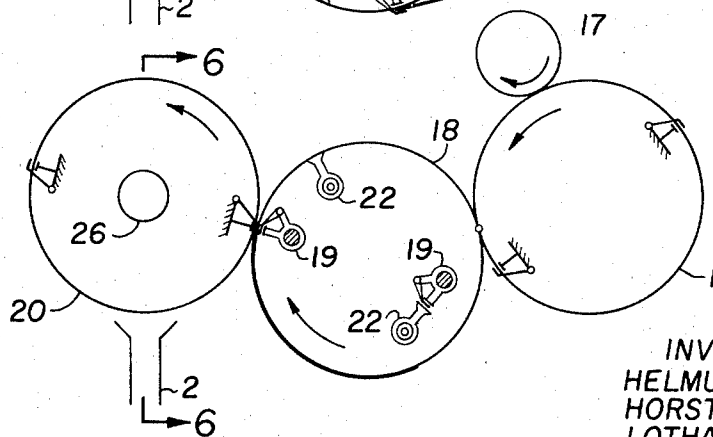


FIG. 5



INVENTORS
HELMUT SCHÖNE
HORST HENKENHAF
LOTHAR VETTER
HORST KRAUSE

BY *Nolte & Nolte*
ATTORNEYS

FIG. 6

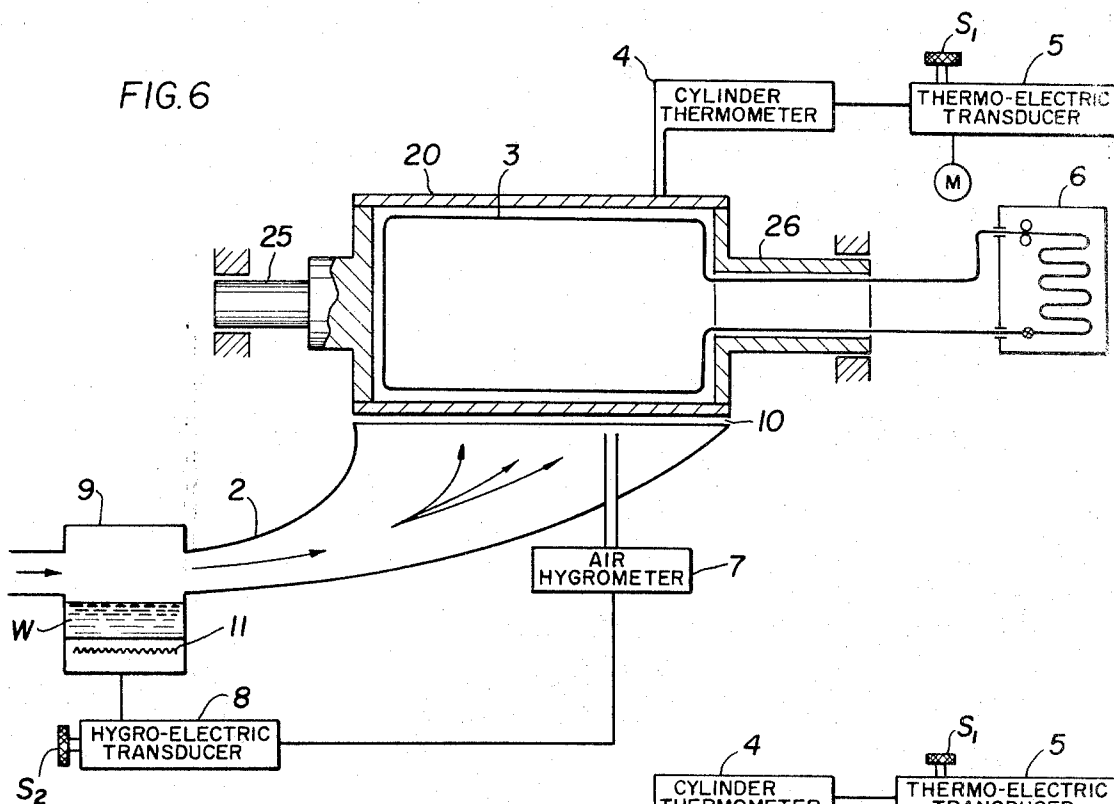
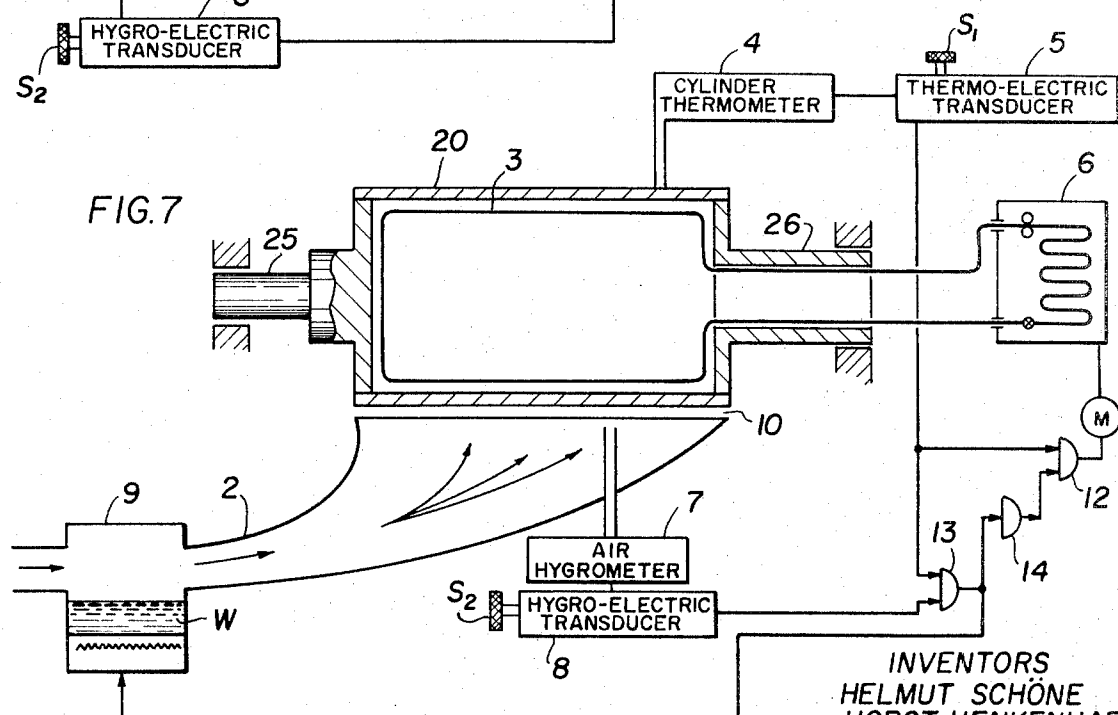


FIG. 7



INVENTORS
HELMUT SCHÖNE
HORST HENKENHAF
LOTHAR VETTER
HORST KRAUSE

BY *Nolte & Nolte*
ATTORNEYS

HUMIDITY REGULATING SYSTEM FOR PRINTING MACHINES

BACKGROUND AND NATURE OF THE INVENTION

Printing machines, and mainly color offset machines and perfectors, require sensitive regulation with respect to humidity on the printing plates, if high quality prints shall be made. A certain amount of humidity, and particularly a certain film thickness thereof is required. It is subject to the influence of numerous factors, among which the humidity and temperature of the ambient air, the paper used, the print thereon and the printing pressure are particularly important. Generally, humidity is absorbed in the paper and evaporated in the air, and must therefore be resupplied, but most of the governing factors are subject to variations. Since even minor changes can have serious effects on the printing process, continuous sensitive regulation of the surface humidity is needed. In conventional practice, a substantial part of the time spent by service and supervisory personnel is directed to such regulation. That kind of supervision and regulation is expensive, and is not necessarily reliable all the time.

Color printing perfectors (which print obverse and selectively also reverse sides, often in a plurality of colors) are particularly susceptible to dangers of improper color application. The obverse printed surface of a sheet comes into contact with a subsequent cylinder when the sheet is not yet entirely dry, thereby creating a danger of color removal and subsequent color transfer, at points where such things are distinctly unwanted. At the same time, the humidity conditions decisive for required color application often are impaired. This applies mainly when the machines operate rapidly, as of course is desirable. It will be seen that the quality of the printed product can be influenced also by the color applied, the position of the paper, and the printing velocity.

Color transfer is conventionally counteracted by application of color rejecting layers. They too influence the humidity conditions considered here; conversely, a humidity layer can be used as a color rejecting medium. In any event, the film of humidity requires regulation.

It has been proposed to regulate the thickness of a film of humidity by applying a mixture of cold and warm air to an offset plate. One partial air stream can be cooled by a refrigerating evaporator, and can then be combined with another partial air stream; both partial streams can be regulated in order to regulate the precipitation of humidity. It is also known that the used, mixed air can be recirculated into the ambient, and returned to the air circuit in the printing plant, thereby providing a kind of pneumatic interconnection between air output and air input conditions.

It is also known to spray a mixture of air and water onto the cylinder by humidifier jets or the like, arranged in an elongated chest which extends over the width of the cylinder. In such devices, the pressure and flow rate of water and air can be regulated by valves, which have generally been operated manually.

Systems of the indicated type have the disadvantage that the partial air or water streams must be throttled individually and that uninterrupted observation of various conditions is necessary to obtain a print of reasonable quality. The invention serves to improve these con-

ditions by regulating the humidity on cylinders of printing presses without a need for constant human supervision, and to achieve uniformly improved printing quality by continuous automatic supply and regulation of humidity. The new system automatically equalizes the thickness of the film of humidity by a suitable response to mechanically measured characteristics which prevail, on the one hand, on the cylinder surface and, on the other hand, in the air stream supplied thereto. Desirably, the measuring and regulating subsystems for the cylinder surface and the air stream are interconnected by electric gating provisions, as will be described hereinafter.

IN THE DRAWINGS

The invention is illustrated by way of example in the accompanying drawings which form a part of this application and in which:

FIG. 1 is a schematic side view, showing a two-color offset printing perfecter and the direction of motion of cylinders thereon;

FIGS. 2 to 5 show the sheet reversing and second color printing elements of the same machine in four different positions;

FIG. 6 is a sectional view generally taken along lines 6—6 in FIG. 5; and

FIG. 7 is a modification of FIG. 6.

DESCRIPTION OF PREFERRED EMBODIMENTS

For general orientation, FIG. 1 shows a first printing cylinder 1 and channel 2 for supply of humid air to a second printing cylinder 20. The two cylinders are mechanically interconnected by transfer and sheet turning means 18, the operations of which are illustrated in FIGS. 2 to 5, as will be described hereinafter. Channel 2 for the control of humidity on cylinder 20 is shown schematically in FIGS. 1 to 5, and in greater detail, in FIG. 6.

As indicated by the latter figure, channel 2 applies humidified air, through nozzle 10, to the surface of cylinder 20, while evaporator pipes 3 of a refrigerating system are provided within the cylinder to cool the cylinder surfaces to a temperature below the dew point of the air. This arrangement causes humidity to precipitate from the ambient and applied air, onto the cylinder surface, in order to form the required film of humidity. Cylinder 20 is rotatably supported by axles 25, 26, one of which is hollow to allow insertion of pipes 3, connected with stationary compressor-condensor unit or refrigerator 6.

The thickness of the film of humidity on cylinder 20 is regulated by interaction of two subsystems. One of these comprises refrigerant system 3 and refrigerator 6 thereof, while the other provides air inlet channel 2 and humidifiers 9 therein. The first or principal subsystem or condition-regulating circuit, has temperature measuring means or thermometer 4 on the outer cylinder surface. This thermometer responds to the temperature of the metal and of the directly surrounding layer of humidity and air. A thermo-electric transducer 5 receives the temperature measurement and produces an electric response thereto, which is impressed for example on motor M of refrigerator 6 for the cylinder-cooling coils 3, to suitably cycle the refrigerator and thereby downwardly to adjust the temperature of the outer

cylinder surface. As the temperature in this area is progressively lowered below the dew point of the air, more humidity is precipitated from the air. A desired temperature, to be measured at 4, is applied to the subsystem by a suitable setting of a set value member S_1 of transducer 5, this set value being chosen empirically on previous observation of operating results influenced by the various factors. In response thereto, transducer 5 causes refrigerator 6 to cycle, so as to precipitate certain amounts of humidity, dependent mainly on the actual temperature measured at 4 and the amount of relatively warm, humid air supplied through channel 2. More frequent cycling of the refrigerator causes evaporator 3 and cylinder 20 to become cooler, and accordingly causes a tendency to precipitate more humidity from the supplied air, so long as the characteristics of this air itself remain uniform.

The latter characteristics, as already indicated, are regulated by the subsystem which includes air channel 2. It also includes an air hygrometer 7, adapted to measure the humidity content of the air coming from this channel, through nozzle 10. The measurement is impressed on hygro-electric transducer 8, having a set value setter S_2 and impressing an electric output on humidifier 9 in channel 2. The exact temperature and humidity of the air are modified by electric heater 11 in evaporator 9. The humidity of the applied air increases in response to humidity measured at 7, so long as the amount of applied air, that is, the velocity of the air stream in duct 2, remains the same. This velocity of course is influenced by the operation of a blower, not shown, which introduces ambient air into channel 2.

Thus, it will be seen that in the new system surface conditions on cylinder 20 are regulated by regulation of characteristics of air in outlet 10 of channel 2, and by the cycling of refrigerating coil 3.

When the humidity or temperature of ambient air changes, for example due to climatic influences, hygrometer 7 measures an actual humidity different from the one set at S_2 and causes regulator 8 to activate heater 11 in humidifier 9, thereby heating water W and introducing more humidity into the supplied air. This operation leads to gradual change of the measurements at 7 and 4. Pursuant to the change at 7, regulator 8 ultimately deactivates heater 11. In this way, heater 11 as well as refrigerator 6 are cycled, depended on measuring and regulating operations in the two regulating circuits or subsystems.

The air, more or less humidified at 9 and more or less dehumidified at 3, may ultimately reenter the ambient of the machine. If the surrounding space is small and atmospheric conditions do not change abruptly, a certain degree of uniformity of operation is established by such pneumatic feedback.

However, it is preferred to link the principal regulating circuit to the auxiliary one in a positive way, which can be relied on regardless of size and condition of ambient spaces. Means for this purpose are shown in FIG. 7. In this figure the basic functions of the principal and auxiliary subsystems can be the same as above, but the way in which the thermo-electric and hygro-electric transducers impress their output on other elements is modified by interposition of gate elements 12, 13 and 14.

An AND gate 12 is interposed between regulator 5 of the principal circuit and refrigerator 6 thereof. An AND gate 13 is interposed between regulator 8 of the auxiliary circuit and humidifier 9 thereof. The latter AND gate also receives an input from regulator 5, and also applies an output, through an inverter gate 14, to AND gate 12. The operation is as follows:

If the film of humidity at 4 is too thin, particularly due to excessively high temperature of the cylinder surface, meter 4 signals this fact to regulator 5, which so signals to the first input of AND gate 12 and the second input of AND gate 13. The latter gate provides no signal since regulator 8 does not send a signal to the first input thereof. Accordingly, inverter gate 14 transmits a signal to AND gate 12. As signals thus occur on the first and second input of AND gate 12, motor M of refrigerator 6 is cycled "on" and the cylinder surface is cooled. When the temperature measured at 4 corresponds to that set at S_1 , refrigerator 6 is cycled "off."

If, on the other hand, the film of humidity at 4 is too small due to insufficient humidity of the air arriving through channel 2, meter 4 again so signals to regulator 5, first input of AND gate 12, and second input of AND gate 13. At the same time, meter 7 then signals to regulator 8 and thereby to the first input of AND gate 13. As signals now occur on the first and second inputs of AND gate 13, they are passed by the gate and cause actuation of heater 11 in humidifier 9. No signal now occurs in the output of AND gate 12 due to inversion at 14, and refrigerator 6 is not cycled "on."

If, finally, the film of humidity is too thin due to both influences (excessive temperature of the cylinder and defective humidity of incoming air) both meters 4 and 7 produce signals, which initially cause regulation of air humidity and thereafter cause regulation of cylinder temperature, as described above.

As noted above, this regulation is applied to the second cylinder 20 of the offset perfecter illustrated here. As already indicated, this is particularly useful when this cylinder receives preprinted sheets, with drying color contacting the cylinder wall. The way in which this kind of operation can be brought about is illustrated in FIGS. 1-5.

Normally, as shown in FIG. 1, printing sheet S is introduced into the machine over feed table F and a swinging gripper mechanism, schematically shown at 15. Applicator drum 16 then feeds the sheet to grippers G of first printing cylinder 1, and thereby causes it to be printed, in a first color, with the aid of offset roller 17. Grippers G thereafter release the front edge of the sheet to grippers 19 of transfer cylinder 18, which apply it to second printing cylinder 20, for obverse printing with the aid of offset roller 21. Thereafter, discharge roller D removes the sheet from the machine. In this operation, both printing cylinders print the obverse side of sheet S. In this position, accordingly, the humidity control system need not be adjusted for any transfer of color to the cylinder surface itself. Set value setters S_1, S_2 FIGS. 6 and 7, can be adjusted accordingly.

Different setting of these instruments is generally required when the machine is set to reverse the printing sheet between cylinders 1 and 20, as can be done by suitable setting leverage, not shown. The beginning of a sheet-reversal process is shown by FIG. 2. Sheet 1, having been printed at 1, 17 as in the former case, is not

immediately released when its front edge arrives at transfer cylinder 18, but is carried on by cylinder 1, where suction members 22 in this cylinder engage the rear edge of this sheet and cause this edge to follow the motion of cylinder 18. Thereafter (FIG. 3) grippers 19 in cylinder 18 engage the rear edge, while (FIG. 4) suction means 22 release this edge and grippers 19 then transport the sheet to cylinder 20 for reverse printing (FIG. 5). In this operation, the regulation system desirably is set to the aforementioned condition modified by the presence of partly dried color which carries into contact with the surface of cylinder 20.

While the new regulation system is of particular advantage in the maintenance of proper conditions on an obverse-reverse printing press (or perfecter), it will be evident to persons skilled in the art that similar regulation is also a substantial advantage in simpler printing operations, particularly an offset machine. For this reason, FIG. 1 schematically shows a humidity regulation system 24 also for offset system 21, 23, to maintain predetermined humidity characteristics on the surface of cylinder 23. The illustration shows a similar system 26 to maintain suitable conditions on the surface of cylinder 25 for offset unit 17 of the first press cylinder 1.

What is claimed is:

1. A system for regulating the thickness of the film of humidity on a printing cylinder surface, particularly in a color offset process and perfecter, said system comprising: means for applying a stream of moist air to the cylinder surface under variable conditions as to flow rate or moisture content or both; means for variably cooling the cylinder to precipitate moisture of the air on the cylinder surface; means for varying at least said one of said conditions of the stream of air; a principal subsystem including thermometer means to measure temperatures at the cylinder surface, and a regulator for regulating the cooling means in response to the measured temperatures; and an auxiliary subsystem including means for measuring at least one of said conditions of the stream of air, and a regulator for regulating said condition in response to its measurement; two AND gates, interposed respectively between the regulator of the principal subsystem and the cooling means, and between the regulator of the auxiliary subsystem

and the means for varying a condition of the stream of air; a connection between the output of the principal regulator and an input of the other AND gate; and a connection, including an inverter gate, between the output of the auxiliary AND gate and an input of the principal AND gate.

2. A system according to claim 1, wherein said means to measure conditions of said stream includes a hygrometer applied to said stream.

3. A system according to claim 2, wherein said means for responding to measured conditions includes a thermo-electrical transducer adapted to regulate the means for cooling, and a hygro-electrical transducer adapted to regulate the means for applying moist air.

4. A system according to claim 1, wherein the means for regulating said condition of said stream of air includes a humidifier interposed in said stream, and means for regulating the humidifier in response to the measured condition existing in said stream.

5. A system for regulating humidity on a work surface, such as that of a printing cylinder, comprising means for applying a stream of moist air to the surface; controlling the moisture content of said stream, means for variably cooling the surface; means to measure the moisture content of said stream of air; means to measure the temperature of said surface, and means for responding to the measured conditions and comprising them to predetermined conditions, wherein said means to measure conditions includes separate measuring means, one on said surface and one in said stream; said means for responding to said conditions including separate measurement-regulation transducers, one having said cooling means as a follower applied to said surface and the other having as a follower said means controlling the moisture content of said stream; the system also including gating means to make the response of one follower dependent on its transducer and the other transducer, and wherein said gating means include an AND gate between each transducer and its follower, each transducer also having an output applied to the other AND gate, and one such output being so applied across an inverter.

6. A system according to claim 5, wherein the inverter is in the output of the AND gate of the means for measuring conditions in said stream of air.

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